

REMARKS

Claims 1-7 and 10-27 remain pending in the present application. Claims 8, 9 and 28-51 have been canceled in the amendments above. Independent claim 6 has been amended to include the limitations of now canceled dependent claims 8 and 9. Dependent claims 14, 17 and 23 have each been converted to independent form by incorporating the limitations of original claims 6 and 8 in each of these claims. Since the Examiner objected to original claims 14-26 but for their dependence on a rejected base claim, Applicants respectfully submit that claims 14-26 are now allowable. The dependency of claim 27 has been corrected so as to depend directly from amended claim 6. Accordingly, it is respectfully submitted that claim 27 should be rejoined for examination. Further, Applicants believe that claims 6, 7, 10-13 and 27 are likewise allowable over the art of record, as will be discussed immediately hereinafter.

The § 102 Rejections

The Examiner rejected original claims 6-9 and 12-13 under 35 U.S.C. § 102(e) as being unpatentable over U.S. Patent no. 6,392,187 issued to Johnson et al (hereinafter the Johnson patent). Applicants respectfully traverse at least for the reasons given below and will discuss the rejections in view of the manner in which the subject limitations have been presented above in the amended claims.

Initially considering the limitations of claim 6, as amended to include the limitations of now canceled claims 8 and 9, this claim now recites a method for use with a processing chamber that uses an inductively coupled plasma source defining an axis of symmetry which produces a plasma density having a given radial variation characteristic across a treatment surface of a treatment object therein using a given electrostatic shield. The method includes configuring an electrostatic shield arrangement to replace the given electrostatic shield in a way which provides for producing a modified radial variation characteristic across the treatment surface which is different than the given radial variation characteristic and, further, the electrostatic shield arrangement is configured to include at least a sidewall arrangement having a shape that extends through a range of radii relative to the axis of symmetry having a modified slot arrangement that is made up of a plurality of elongated modified slots, each of which includes a length in the sidewall that extends through at least a portion of the range of radii and each of which includes a width that varies at least partially along the length for producing the modified radial variation characteristic.

The Johnson patent cylindrical shield includes slots of a non-uniform width. In this regard, it is noted that Figures 10A-10C illustrate slot shapes plotted against plasma density for any given location along the length of the slot. A slotted cylindrical shield, however, is illustrated by figures 11A-11C of the patent. In this regard, col. 11, ln. 59 carrying over to col. 12, ln. 34, describes the cylindrical shields of figures 11A-11C. In each case, however, the discussion is focused upon creating a plasma density gradient along the axial length of each shield to produce a gradient of plasma density from the top of the shield to the bottom of the shield, in the view of the figures. Applicants are unable to find any mention of radial variation in the plasma density. That is, these figures and their associated descriptions do not speak to any radial variation in plasma density that would be associated with each slot. Accordingly, it can be assumed that the plasma density that is associated with and produced by each slot shape is radially uniform. It is, however, unreasonable to assume that any significant radial variation in plasma density would be present at least for the reason that processing would be adversely

affected by a radial gradient. When viewed in this light, it is clear that the combined limitations of amended claim 6 have not been met by Johnson for this reason standing on its own, since the varying slot width in Johnson is not described as influencing radial variation in plasma density even immediately adjacent to one of the slots. Further, there is no description which would reasonably relate to producing a modified radial variation characteristic across the treatment surface which is, in fact, remote and spaced away from the locations of the slots in the shield. Accordingly, for at least these reasons, allowance of claim 6 over Johnson is respectfully requested.

Still considering the limitations of amended claim 6, this claim now recites that the shield arrangement includes at least a sidewall arrangement having a shape that extends through a range of radii relative to the axis of symmetry and, further, that each slot includes a length in the sidewall that extends through at least a portion of the range of radii and each slot includes a width that varies at least partially along its length for producing the modified radial variation characteristic. The Examiner asserts that the Johnson reference meets the limitations of original claims 6-9, and thereby those of amended claim 6, with reference to col. 15, lns. 15-25 and Figures 11A-11C. Applicants respectfully disagree. As discussed above, these figures and their associated descriptions are merely directed to a cylindrical electrostatic shield that is characterized by an axis of symmetry and one sidewall radius. The limitations with respect to a sidewall that extends through a range of radii so that the length of each slot extends through at least a portion of the range of radii clearly have not met by the Johnson reference when viewed in a reasonable light. Accordingly, for this reason standing on its own, allowance of claim 6, as amended, is respectfully requested.

Claims 7, 12 and 13, as amended, each depend directly from and therefore include the limitations of amended claim 6. Accordingly, it is respectfully submitted that each of these claims is also patentable over the art of record for at least the reasons set forth above with respect to amended claim 6. Further, each of these dependent claims places additional limitations on amended claim 6 which further distinguish the claimed invention from the art of record.

For example, claim 7, as amended, recites using the electrostatic shield arrangement to produce a modified radial variation characteristic as being more constant across the treatment surface than the given radial variation characteristic. In this regard and as discussed above, the Johnson patent is directed to producing a plasma gradient along the length of the shield and treatment chamber for purposes of influencing particle acceleration. Applicant is unable to find any teaching, disclosure or suggestion in the patent that appears to be reasonably related to influencing variation of plasma density radially, at the treatment surface, which is remote from the shield and slots, as is clearly illustrated by Figure 1 of the Johnson patent. Accordingly, for at least these reasons, allowance of amended claim 7 is respectfully requested.

As another example, claim 12 recites that the electrostatic shield arrangement is at least generally dome-shaped in configuration. Applicant finds no reasonably related teaching, disclosure or suggestion of such a shape in the Johnson patent or the remaining art of record. Accordingly, for at least these reasons, allowance of claim is respectfully requested.

As a further example, claim 13, as amended, recites that the electrostatic shield arrangement includes a plate-like upper surface that is arranged to intersect the axis of symmetry and each of the elongated modified slots extends from the sidewall and at least partially across said plate-like upper surface. Applicants respectfully submit that the art of record is devoid of this combination of limitations, when viewed in any reasonable light.

The § 103 Rejections

The Examiner rejected original claims 10 and 11 under 35 U.S.C. § 103(a) as being unpatentable over the Johnson patent in view of Applicants' admitted prior art. Claim 10 recites an electrostatic shield having a conical shape, while claim 11 recites an electrostatic shield having a frustoconical shape. Applicant respectfully traverses at least for the reasons that are discussed below.

Initially, it is noted that Applicants' admitted prior is considered to contribute nothing to the rejections of claims 6, 7, 12 and 13, as amended, over the Johnson patent under § 102, as discussed above for reasons that will made apparent. In particular, prior art Figure 1 of Applicants' disclosure merely illustrates a frustoconical electrostatic shield having slots that are of uniform width. Paragraph 8 of Applicants' disclosure, with respect to the source of Figure 1, states:

Normally, the most persistent non-uniformity in such plasma sources is the radial non-uniformity. Until this time, the normal way to reduce this type of plasma non-uniformity to low levels has been to use a large plasma source diameter.

What is being discussed is the radial non-uniformity of a source having a frustoconical shield. The problem that is being solved, with respect to the source of Figure 1, is that of radial non-uniformity when a shield is used having a sloping sidewall. What is not being discussed is radial non-uniformity in a source such as the cylindrical source of the Johnson patent. In this regard, paragraph 76 of Applicants' specification states:

Again considering the aforedescribed invention by Johnson, only a cylindrical shield is taught. The highly advantageous two-part slotted shield of the present invention, for varying plasma radial uniformity, is not a cylindrical shield. The present invention recognizes that a shield with a shape that covers a range of radii relative to the symmetry axis of the system (i.e., part of a cone surface, flat-top, or dome surface) is highly advantageous. With this type of shield, the slot variability is capable of producing a change in the radial distribution of power injection into the plasma. This change in the power injection distribution results in a change in the radial density distribution of the plasma.

While the foregoing paragraph is framed in terms of a two-part shield, it clearly enjoys applicability with respect to any shield with a shape that covers a range of radii with respect to the axis of symmetry. In this regard, a cylindrical source does not exhibit the behavior that Applicants' have discovered in a source have a shield with a sloping sidewall with respect to influencing radial plasma density at the treatment surface.

As is exemplified by the Johnson patent, radial non-uniformity with the cylindrical source is not of concern in the prior art, particularly since Johnson does not even discuss it. Further, even if radial non-uniformity were of concern in Johnson, with which Applicants disagree, there is no reason to assume that the problem would not be solved by simply increasing the diameter of the source, as is taught by the prior art. Accordingly, Applicants would have no motivation to look to the Johnson reference in order to arrive at the combination of limitations that are present in claim 10 or claim 11, at least for the reason that Johnson fails to teach, disclose or reasonably suggest solving the problem of radial non-uniformity by modification of slot width in a frustoconical electrostatic shield or, for that matter, in any shield which includes a sloping sidewall that defines the varying width slots across a range of radii. The varied width slots in Johnson, in contrast, are directed to producing a plasma gradient along the axial length of the shield, and are not directed to changing the radial plasma distribution at the treatment surface. For at least these reasons, it is respectfully submitted that the proposed

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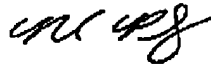
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modification of Johnson to include the frustoconical shield of Figure 1 is not reasonable. Accordingly, allowance of claims 10 and 11 is respectfully requested.

For the foregoing reasons, it is respectfully submitted that all of the Examiner's objections have been overcome and that the application is in condition for allowance. Hence, allowance of these claims and passage to issue of the application are solicited.

If the Examiner has any questions concerning this case, the Examiner is respectfully requested to contact Mike Pritzkau at 303-410-9254.

Respectfully submitted,



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